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Attorney Docket # 4780-19 Patent

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Otto LENHERR

Serial No.: n/a

Filed: concurrently

For: Process for Manufacturing Components of Fibre-Reinforced Plastics

Assistant Commissioner for Patents
Washington, DC 20231

PRELIMINARY AMENDMENT

S I R:

Prior to the issuance of a first Office Action and simultaneously with the filing of the present application, please amend said application as follows:

IN THE SPECIFICATION:

Page 1, line 2 insert --BACKGROUND OF THE INVENTION--;

the paragraph starting at line 3:

The present invention relates to a process for manufacturing single part fibre-reinforced components having at least one closed or undercut space, in particular a resin-flow moulding or a Resin Transfer Moulding (RTM) process, whereby a shape-stable supporting core

(hereinafter simply core) to create the hollow space in the fibre-reinforced component is manufactured and a mould with a cavity is charged at least with fibre material and the core, and a plastic matrix capable of flowing is injected into the cavity of the closed mould forming a shaped fibre-composite mass soaked in plastic matrix, and the fibre-composite mass is hardened resulting in a fibre-reinforced component. Further, the invention also concerns the production of the core and a device for carrying out the process according to the invention as well as fibre-reinforced components manufactured using the process according to the invention.

the paragraph starting at line 16:

Fibre-reinforced components or fibre composite components are parts made out of fibre-reinforced plastics. They have gained increasing importance because of their relatively light weight and the high strength due to incorporation of fibres in them, this in particular in road and railway vehicles, aircraft construction, aerospace, structures or light weight structures e.g. for reinforcing purposes, or in sports equipment. Fibre-reinforced components also find increasing use as load-bearing structural components in the above fields, whereby such fibre-reinforced components often exhibit extremely complex three-dimensional geometric shapes.

Page 2, the paragraph starting at line 1:

In the RTM process at least reinforcing fibres, in particular in the form of fibre structures, and as required further components, are placed in the cavity of an open multi-part mould. In a subsequent step a duroplastic or thermoplastic matrix is injected into the cavity of the closed

mould thus forming a fibre-reinforced mass. In a final step the fibre-reinforced mass is hardened or polymerised and the stable-shaped fibre-reinforced component removed from the mould.

Page 3, line 6 insert --SUMMARY OF THE INVENTION--.

Page 4, the paragraph starting at line 36:

Advantageously, the preform is shaped into a core by press-moulding. The pre-form is in particular plastically formed in a press-moulding tool with a shape-forming cavity. The preform is e.g. formed in a multi-part, in particular in a two-part tool containing a shape-forming cavity, whereby the preform is placed in the open-tool cavity and pressed into the contour of the cavity by bringing the parts of the tool together and closing the press-moulding tool. The cavity of the tool usefully reproduces the shape of the hollow space to be created in the fibre-reinforced component. The plastic deformation is usefully completed when the press-moulding tool is completely closed.

the paragraph starting at line 9:

The shape of the press-moulding tool depends on the shape of the core. The parts of the tool may contain partial cavities which on closing the tool together form a closed press-moulding tool cavity. Further, individual press-moulding tool parts may also feature cavity parts which on closing the press-moulding tool form a closed press-moulding cavity. Further, on closing

the press-moulding tool, individual press-moulding tool parts may also be in the form of stems projecting into the cavity.

the paragraph starting at line 25:

The rate at which the deformation process is carried out, i.e. the rate of closing the tool depends on the plastic behaviour or plasticity of the preform, is to be selected such that no brittle behaviour arises and crack formation is avoided. The plastic forming of the preform into the shape of the final core may have a duration e.g. of less than a minute.

Page 6, the paragraph starting at line 31:

In a further version of the invention the core may also be manufactured in an extrusion facility in at least one step involving plastic deformation of a core mass. This solution is particularly suitable if the core is a shaped body of uniform cross-section along its whole length. A core manufactured according to the invention may be of any size e.g. from a few centimeters up to some meters. Likewise the shape of the core has no limits. This may be voluminous, be of a given area, be thin or thick, feature undercuts and other types of complex geometrical shapes.

Page 7, the paragraph starting at line 8:

Apart from waxes the cores may contain fillers such as e.g. mineral type substances. The filler may be employed e.g. to reduce the extent of shrinkage or to influence the temperature of

melting or plasticity. The process described here, however, permits in particular the use of practically pure waxes which exhibit a large degree of shrinkage on solidification, but which have been found by experience to exhibit good run-off melting properties. This means that simply by means of the melting process i.e. without any mechanical aid, the pure waxes can be removed almost completely from the space in the fibre-reinforced component.

Page 9, the paragraph starting at line 12:

Apart from the above mentioned fibre preforms or fibre structures, further reinforcing fibres e.g. textile type, large area fibre structures in the form of layers or laminates may be provided in the fibre-reinforced component. Further, on its outer facing surface in the fibre-reinforced component the fibre preform or fibre structure may be covered over with an outer layer, which enables the fibre-reinforced component to be given a more attractive surface. Also, the fibre-reinforced component with closed or undercut space manufactured according to the invention may – for the purpose of locally increasing the stiffness and resistance to twisting and sagging – be produced in lengths with a sandwich type structure with reinforcing cores, in particular with foam cores of plastic. Apart from supporting cores, the mould may e.g. be fitted in regions with reinforcing cores. Preferred reinforcing cores are foam cores which may be made of polyurethane (PUR), polyvinylchloride (PVC) or a polyolefin. The reinforcing cores may be completely foamed when they are placed in the mould. The reinforcing cores may also be of a kind which, after being placed in the mould, foam out to their final shape during the production of the fibre-reinforced component. The foam core is usefully impervious to fluids. The foam cores may be of the partially or completely open pore type, preferably of the closed

pore type, whereby these are e.g. sealed or closed off at their surface making them impervious to fluids. The reinforcing cores of foam exhibit a density e.g. of 30 – 100 kg/m^3, preferably 60 – 80 kg/m^3. The manner of introducing a reinforcing core into the mould cavity is the same as for a supporting core.

Page 10, the paragraph starting at line 17:

The through-flow of resin is usefully in a cross-stream manner, whereby the feeding of the plastic matrix into the mould cavity may take place via one or more injection nozzles. The injection pressures are e.g. between 1 and 20 bar, preferably between 3 and 15 bar.

Page 13, the paragraph starting at line 11:

The preform obtained from the melting out process directly from the melted core is again plastically shape-formed into a core. In a preferred version of the invention several preforms are kept in store and preforms are continually taken from store to manufacture the cores. The stocks of cores are continually made up of preforms from melted out cores, so that a balanced number of preforms is always on hand, thus allowing the production of fibre-reinforced components to be increased at short notice. The shape-forming of the preforms into cores is advantageously adjusted with respect to the current number of fibre-reinforced components being produced. After shape-forming, the cores are advantageously fed directly to the production process.

Page 14, at line 25 insert --BRIEF DESCRIPTION OF THE DRAWINGS--;

the paragraph starting at line 26:

The invention is explained in greater detail by way of example and with reference to the accompanying drawings which show:

Fig. 1a: a schematic cross-sectional view of a preform made of wax;

Fig. 1b: a schematic cross-sectional view of a press-moulding tool with support-ing core;

Fig. 1c: a schematic cross-sectional view of an RTM- mould containing the core and reinforcing fibres;

Fig. 1d: a schematic cross-sectional view of a fibre-reinforced component in the tempering mould;

Fig. 1e: a schematic cross-sectional view of a casting mould; and

Fig. 1f: a schematic cross-sectional view of a fibre-reinforced component.

Page 15, at line 7 insert --DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS--.

IN THE CLAIMS:

Please cancel claims 1 to 25 and insert

26. A process for manufacturing a single part fibre-reinforced component having at least one closed or undercut hollow space, comprising the steps of:

manufacturing a shape-stable supporting core by plastic deformation from one of a core mass and a preform so as to create the hollow space in the fibre-reinforced component, the supporting core being a shaped part that is meltable above room temperature;

charging a mould with a cavity at least with fibre material and the supporting core;

injecting a flowable plastic matrix into the cavity of the mould thereby soaking the fibre material and forming a shaped fibre-composite mass;

hardening the fibre-composite mass thereby resulting in a fibre-reinforced component; and

melting the supporting core out of the fibre-reinforced component when the component has reached a stable shape containing a closed or undercut hollow space.

27. A process according to claim 26, including plastically shape-forming the supporting core out of a preform.

28. A process according to claim 27, wherein the preform is cast.

29. A process according to claim 28, wherein the preform is cast in a rough shape of a final supporting core shape.

30. A process according to claim 29, including choosing the shape of the preform so that distances the material has to flow during plastic shape-forming are as small as possible and the preform has at least an equal mass with the supporting core being manufactured.

31. A process according to claim 30, wherein the preform has a greater mass than the supporting core.

32. A process according to claim 26, including plastically shape-forming the core mass or the preform at an average temperature greater than 20°C and less than a melting temperature of the core mass or preform, whereby the melting temperature is above 50°C.

33. A process according to claim 32, including plastically shape-forming at an average temperature greater than 35°C.

34. A process according to claim 33, including plastically shape-forming at an average temperature greater than 50°C.

35. A process according to claim 26, wherein the supporting core manufacturing step includes manufacturing the supporting core to contain wax.

36. A process according to claim 35, wherein the wax is one of natural wax, chemically modified wax and synthetic wax.

37. A process according to claim 35, wherein the support core is comprised substantially of wax.

38. A process according to claim 32, wherein the core mass or preform has a melting temperature which is at least 75°C and at most 130°C, and the process including plastically forming the core mass or preform from a temperature of at least 20°C up to the melting temperature.

39. A process according to claim 38, wherein the mass or preform has a melting temperature of at least 85°C.

40. A process according to claim 39, wherein the mass or preform has a melting temperature of at least 90°C.

41. A process according to claim 38, wherein the core mass or preform has a melting temperature of at most 120°C.

42. A process according to claim 41, wherein the core mass or preform has a melting temperature of at most 110°C.

43. A process according to claim 38, including plastically forming the core mass or preform from a temperature of at least 30°C up to the melting temperature.

44. A process according to claim 43, including plastically forming the core mass or preform from a temperature of at least 50°C up to the melting temperature.

45. A process according to claim 26, wherein the supporting core manufacturing step includes manufacturing the supporting core via press-moulding and shape-forming in a cavity of a press-moulding tool.

46. A process according to claim 45, wherein the press-moulding tool has a multi-part mold.

47. A process according to claim 46, wherein the press-moulding tool has a two-part mold, the supporting core manufacturing step including laying the core mass or preform in the open mould cavity and pressing the core mass or preform by bringing the mould parts together and closing the press moulding tool into the shape of the cavity and thereby giving the supporting core a final shape.

48. A process according to claim 26, including laying the preform into an open two-part press moulding tool which forms a tool cavity, the press moulding tool parts forming cavity parts and the press moulding tool cavity making up the hollow space in the fibre-reinforced

component to be manufactured, further including closing the press moulding tool to press the core mass or preform by shape forming into the contour of the press moulding tool cavity to give a shaped supporting core.

49. A process according to claim 45, wherein the core mass or preform exhibits excess material with respect to the final, shaped supporting core and the excess material flows out of the cavity via openings during the press-mould forming, the cavity containing degassing openings to remove trapped pockets of air during the press-mould forming.

50. A process according to claim 26, further including forming a new preform out of the supporting core material removed by melting and leading the molten material from the supporting core directly into a casting mould for producing a new preform.

51. A process according to claim 26, wherein an average temperature of the supporting core during the injection of the plastic matrix into the mould deviates by less than ± 6°C from an average temperature of the core mass or preform during plastic deformation.

52. A process according to claim 51, wherein the average temperature of the supporting core during the injection of the plastic matrix into the mold deviates by less than ± 4°C from the average temperature of the core mass or preform during plastic deformation.

53. A process according to claim 52, wherein the average temperature of the supporting core during the injection of the plastic matrix into the mold deviates by less than $\pm$ 2°C from the average temperature of the core mass or preform during plastic deformation.

54. A process according to claim 45, wherein an average temperature of the supporting core during the injecting of the plastic matrix into the moulding tool corresponds to an average temperature of the core mass or preform during plastic deformation.

55. A process according to claim 26, wherein an average temperature of the supporting core during the injecting of the plastic matrix into the mould is less than 6°C and more than 0°C higher than an average temperature of the core mass or preform during plastic deformation, and further including heating the supporting core one of during and after the injecting of the plastic matrix so that a thermal volume expansion towards the fibre-composite mass of more than 0% and less than 10% results so that pressure is exerted on the fibre-composite mass which leads to the plastic matrix effectively soaking into the fibre mass.

56. A process according to claim 55, wherein the average temperature of the supporting core during the injecting of the plastic matrix into the mould is less than 4°C higher than the average temperature of the core mass or preform during plastic deformation.

57. A process according to claim 56, wherein the average temperature of the supporting core during the injecting of the plastic matrix into the mould is less than 3°C higher than the average temperature of the core mass or preform during plastic deformation.

58. A process according to claim 55, wherein the average temperature of the supporting core during the injecting of the plastic matrix into the mould is more than 1°C higher than the average temperature of the core mass or preform during plastic deformation.

59. A process according to claim 58, wherein the average temperature of the supporting core during the injecting of the plastic matrix into the mould is more than 2°C higher than the average temperature of the core mass or preform during plastic deformation.

60. A process according to claim 55, wherein the thermal volume expansion towards the fibre-composite mass is more than 1%.

61. A process according to claim 60, wherein the thermal volume expansion towards the fibre-composite mass is less than 5%.

62. a process according to claim 61, wherein the thermal volume expansion towards the fibre-composite mass is less than 2%.

63. A process according to claim 26, including producing the fibre-reinforced component in a resin transfer moulding RTM process and the plastic matrix is of a duromer system, the injecting step including injecting the plastic matrix into a cavity of a multi-part RTM-tool at a temperature of about 60°C, the hardening step including hardening the plastic matrix at a temperature of about 70-80°C, and further including removing the fibre-reinforced component

from the mould and tempering the fibre-reinforced component at a temperature of about 90-110°C after removal from the mould, the supporting core being melted out of the fibre-reinforced component during the tempering process.

64. A process according to claim 63, wherein the plastic matrix is of an epoxy resin system.

65. A process according to claim 26, wherein the fibre mass is a pre-formed fibre preform of textile material.

66. A process according to claim 26, wherein the fibre mass is substantially of glass fibres.

67. A process for manufacturing a supporting core for use in manufacturing fibre-reinforced components, the process comprising the step of plastically deforming one of a core mass and a preform so as to form a shaped body that is meltable at a temperature above ambient.

68. A process according to claim 67, including plastically forming the supporting core shaped body from a preform, the preform being cast in a rough shape of the final supporting core, the shape of the preform being such that distances that the material flows during plastic deformation are as short as possible, the preform having a mass which is at least equal to a mass of the supporting core to be produced.

69. A process according to claim 68, including plastically shape-forming the core mass or preform at an average temperature greater than 20°C and less than a melting temperature, the melting temperature being above 50°C.

70. A process according to claim 69, including plastically shape-forming the core mass or preform at an average temperature greater than 35°C.

71. A process according to claim 70, including plastically shape-forming the core mass or preform at an average temperature greater than 50°C.

72. A process according to claim 67, wherein the supporting core contains wax.

73. A process according to claim 72, wherein the wax is one of natural wax, chemically modified wax or synthetic wax.

74. A process according to claim 72, wherein the supporting core is comprised substantially of wax.

75. A process according to claim 69, wherein the core mass or preform has a melting temperature of at least 75°C and at most 130°C, the core mass or preform being plastically shape-formable from a temperature of at least 20°C up to the melting point.

76. A process according to claim 75, wherein the core mass or preform has a melting temperature of at least 85°C.

77. A process according to claim 76, wherein the core mass or preform has a melting temperature of at least 90°C.

78. A process according to claim 75, wherein the core mass or preform has a melting temperature of at most 120°C.

79. A process according to claim 78, wherein the core mass or preform has a melting temperature of at most 110°C.

80. A process according to claim 75, wherein the core mass or preform is plastically shape-formable from a temperature of at least 30°C.

81. A process according to claim 80, wherein the core mass or preform is plastically shape-formable from a temperature of at least 50°C.

82. A process according to claim 67, including producing the supporting core by press moulding and forming in a cavity of a press moulding tool.

83. A process according to claim 82, wherein the press moulding tool has a multi-part mould.

84. A process according to claim 83, wherein the press moulding tool is a two-part moulding tool, the process including laying the core mass or preform in the open cavity of the tool and bringing together the mould parts and closing the press moulding tool so as to press the core mass or preform into the shape of the cavity and thus give the supporting core a final shape.

85. A process according to claim 67, including laying the preform in an open two-part press moulding tool which forms a tool cavity, the press moulding tool parts forming cavity parts and the press moulding tool cavity making up the hollow space in the fibre-reinforced component to be manufactured, the process further including closing the press-moulding tool so as to press the preform by shape forming into the contour of the press-moulding tool cavity so as to form the supporting core.

86. A process according to claim 84, including forming the preform so that the preform has, with respect to a final shape of the supporting core, an excess of material which excess material flows, during plastic deformation, out of the press moulding to a cavity via openings, the press moulding tool cavity having degassing openings for removing trapped pockets of air.

87. A device for manufacturing a supporting core for use in manufacturing fibre-reinforced components, the device comprising a two-part press moulding tool movable between an open position and a closed position, the press moulding tool forming a cavity in the closed position, which cavity reproduces a hollow space in the fibre reinforced component to be produced.

88. A device according to claim 87, wherein the press moulding tool has degassing openings for permitting air to escape from trapped air pockets, the press moulding tool further having drainage openings leading to drainage chambers to permit drainage of excess material from the preform out of the tool cavity.

89. A single part fibre-reinforced component manufactured by producing a shape-stable supporting core by plastic deformation from one of a core mass and a preform so as to create the hollow space in the fibre-reinforced component, the supporting core being a shaped part that is meltable above room temperature, charging a mould with a cavity at least with fibre material and the supporting core, injecting a flowable plastic matrix into the cavity of the mould thereby soaking the fibre material and forming a shaped fibre-composite mass, hardening the fibre-composite mass thereby resulting in a fibre-reinforced component, and melting the supporting core out of the fibre-reinforced component when the component has reached a stable shape containing a closed or undercut hollow space, the fibre-reinforced component having a fibre content by volume of more than 30% and at least one closed or undercut space, the component further having a span of shape and dimensional tolerances that is less than 5% with reference to a nominal value.

IN THE ABSTRACT:

Please cancel the present abstract and insert the following therefore:

A Resin Transfer Moulding (RTM) process for manufacturing fibre-reinforced components with at least one closed or undercut space. A two-part mould with a cavity is charged with reinforcing fibres and a shape-stable supporting core of wax that can be melted out of the cavity. The core is produced from a cast preform by at least one shape-forming step. A plastic matrix capable of flowing is injected into the cavity of the closed mould forming a shaped fibre-composite mass and hardened to give the fibre-reinforced component. The shape-stable fibre-reinforced component is removed from the mould and subjected to tempering. During tempering the core is melted and drained off from the fibre-reinforced component - leaving behind a closed or undercut space – and the molten core material is cast to provide a new preform .

REMARKS

The present amendment is submitted prior to the issuance of a first Office Acton and simultaneously with the filing of the present application.

With this amendment applicants have amended the specification, cancelled claims 1 to 25 and added new claims 26 to 89, all in an effort to place the application in better condition for examination.

Favorable action on the present application is respectfully requested.

Any additional fees or charges required at this time in connection with the application may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

Respectfully submitted,

COHEN, PONTANI, LIEBERMAN & PAVANE

By ____________________

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October 4, 2001

IN THE SPECIFICATION:

Page 1, starting at line 3:

The present invention relates to a process for manufacturing single part fibre-reinforced components having at least one closed or undercut space, in particular a resin-flow moulding [resp.] or a Resin Transfer Moulding (RTM) process, whereby a shape-stable supporting core (hereinafter simply core) to create the hollow space in the fibre-reinforced component is manufactured and a mould with a cavity is charged at least with fibre material and the core, and a plastic matrix capable of flowing is injected into the cavity of the closed mould forming a shaped fibre-composite mass soaked in plastic matrix, and the fibre-composite mass is hardened resulting in a fibre-reinforced component. Further, the invention also concerns the production of the core and a device for carrying out the process according to the invention as well as fibre-reinforced components manufactured using the process according to the invention.

starting at line 16:

Fibre-reinforced components [resp.] or fibre composite components are parts made out of fibre-reinforced plastics. They have gained increasing importance because of their relatively light weight and the high strength due to incorporation of fibres in them, this in particular in road and railway vehicles, aircraft construction, aerospace, structures or light weight [struct-ures] structures e.g. for reinforcing purposes, or in sports equipment. Fibre-reinforced [com-ponents] components also find increasing use as load-bearing structural components in the

above fields, whereby such fibre-reinforced components often exhibit extremely complex three-dimensional geometric shapes.

Page 2, starting at line 1:

In the RTM process at least [fibre-reinforcing] reinforcing fibres, in particular in the form of fibre structures, and as required further components, are placed in the cavity of an open multi-part mould. In a subsequent step a duroplastic or thermoplastic matrix is injected into the cavity of the closed mould thus forming a fibre-reinforced mass. In a final step the fibre-reinforced mass is hardened or polymerised and the stable-shaped fibre-reinforced component removed from the mould.

Page 4, starting at line 36:

Advantageously, the preform is shaped into a core by press-moulding. The pre-form is in particular plastically formed in a press-moulding tool with a shape-forming cavity. The preform is e.g. formed in a multi-part, in particular in a two-part tool containing a shape-forming cavity, whereby the preform is placed in the open-tool cavity and pressed into the contour of the cavity by bringing the parts of the tool together and closing the press-moulding tool. The cavity of the tool usefully reproduces the shape of the hollow space to be created in the fibre-reinforced component. The plastic deformation is usefully completed when the press-[mould-ing] moulding tool is completely closed.

Page 5, starting at line 9:

The shape of the press-moulding tool depends on the shape of the core. The parts of the tool may contain partial cavities which on closing the tool together form a closed press-moulding tool cavity. Further, individual press-moulding tool parts may also feature cavity parts which on closing the press-moulding tool form a closed press-moulding cavity. Further, on closing the press-moulding tool, [individ-ual] individual press-moulding tool parts may also be in the form of stems projecting into the cavity.

starting at line 25:

The rate at which the deformation process is carried out, i.e. the rate of closing the tool depends on the plastic behaviour or plasticity of the preform, is to be selected such that no brittle behaviour arises and crack formation is avoided. The plastic forming of the preform into the shape of the final core may have a duration e.g. of less than a minute.

Page 6, starting at line 31:

In a further version of the invention the core may also be manufactured in an extrusion facility in at least one step involving plastic deformation of a core mass. This solution is particularly suitable if the core is a shaped body of uniform cross-section along its whole length. A core manufactured according to the invention may be of any size e.g. from a few [centimetres] centimeters up to some [metres] meters. Likewise the shape of the core has no limits. This may

be voluminous, be of a given area, be thin or thick, feature undercuts and other types of complex geometrical shapes.

Page 7, starting at line 8:

Apart from waxes the cores may contain fillers such as e.g. mineral type substances. The filler may be employed e.g. to reduce the extent of shrinkage or to influence the temperature of melting or plasticity. The process described here, however, permits in particular the use of practically pure waxes which exhibit a large degree of shrinkage on solidification, but which have been found by [exper-ience] experience to exhibit good run-off melting properties. This means that simply by means of the melting process i.e. without any mechanical aid, the pure waxes can be removed almost completely from the space in the fibre-reinforced component.

Page 9, starting at line 12:

Apart from the above mentioned fibre preforms or fibre structures, further reinforcing fibres e.g. textile type, large area fibre structures in the form of layers or laminates may be provided in the fibre-reinforced component. Further, on its outer facing surface in the fibre-reinforced component the fibre preform or fibre structure may be covered over with an outer layer, which enables the fibre-reinforced component to be given a more attractive surface. Also, the fibre-reinforced [com-ponent] component with closed or undercut space manufactured according to the invention may – for the purpose of locally increasing the stiffness and resistance to twisting and sagging – be produced in lengths with a sandwich type structure with reinforcing cores, in

particular with foam cores of plastic. Apart from supporting cores, the mould may e.g. be fitted in regions with reinforcing cores. Preferred reinforcing cores are foam cores which may be made of polyurethane (PUR), polyvinylchloride (PVC) or a polyolefin. The reinforcing cores may be completely foamed when they are placed in the mould. The reinforcing cores may also be of a kind which, after being placed in the mould, foam out to their final shape during the production of the fibre-reinforced component. The foam core is usefully impervious to fluids. The foam cores may be of the partially or completely open pore type, preferably of the closed pore type, whereby these are e.g. sealed or closed off at their surface making them impervious to fluids. The reinforcing cores of foam exhibit a density e.g. of 30 – 100 kg/m^3, preferably 60 – 80 kg/m^3. The manner of introducing a reinforcing core into the mould cavity is the same as for a supporting core.

Page 10, starting at line 17:

The through-flow of resin is usefully in a cross-stream manner, whereby the feeding of the plastic matrix into the mould cavity may take place via one or more injection nozzles. The injection pressures are e.g. between 1 and 20 bar, [prefer-ably] preferably between 3 and 15 bar.

Page 13, starting at line 11:

The preform obtained from the melting out process directly from the melted core is again plastically shape-formed into a core. In a preferred version of the invention several preforms are kept in store and preforms are continually taken from store to manufacture the cores. The stocks of cores are continually made up of preforms from melted out cores, so that a balanced number of preforms is always on hand, thus allowing the production of fibre-reinforced components to be increased at short notice. The shape-forming of the preforms into cores is advantageously adjusted with respect to the current number of fibre-reinforced components being produced. After shape-forming, the cores are advantageously fed directly to the production process.

Page 14, starting at line 26:

The invention is explained in greater detail by way of example and with reference to the accompanying drawings which show:

Fig. 1a: a schematic cross-sectional view of a preform made of wax;

Fig. 1b: a schematic cross-sectional view of a press-moulding tool with support-ing core;

Fig. 1c: a schematic cross-sectional view of an RTM- mould containing the core and reinforcing fibres;

Fig. 1d: a schematic cross-sectional view of a fibre-reinforced component in the tempering mould;

Fig. 1e: a schematic cross-sectional view of a casting mould; and

Fig. 1f: a schematic cross-sectional view of a fibre-reinforced component.